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The purpose of an experimental plan for training technically oriented students in the last two years of high school is to motivate underachievers, potential dropouts, and problem students with mechanical aptitudes so that they can realize concrete goals leading either to employment or to continued education.

The program is composed of a two-year sequence of English, physics, chemistry, mathematics through trigonometry and technical laboratory (an integrated shop course including drafting). History, social studies, and physical education are taken in conjunction with other students.

Techniques utilized are team teaching by teachers trained in summer workshops and who confer weekly to review, evaluate, and plan; programed instruction for English and mathematics; correlation of academic subjects to the technological laboratories; and continuous theory-application methods.

The program is financed by the Rosenberg Foundation. A three-year grant of $185,000 allows Cogswell Polytechnical College, a two-year technical institute, to develop the curriculum completely and to extend it to ten high schools and to two public junior colleges who will revise their curriculums to adapt to the needs of graduates of the experimental high schools.

Appended is a pamphlet that describes the preparation of curriculum materials and an instructional program, emphasizing the specification of objectives, the preparation of requirements, evaluative procedures, content outlines, course sequences, and teaching methods.


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# The RICHMOND PLAN

U. S. DEPARTMENT OF HEALTH, EDUCATION AND WELFARE
Office of Education

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# THE PRE-TECHNICIAN PREPARATORY PROGRAM

## (THE RICHMOND PLAN) - 1962

**WHAT IS IT?**

A proposed Program to prepare capable average students for a two year technical institute program in public or private junior colleges.

**WHAT IS THE NEED FOR THIS PROGRAM?**

Automation is requiring more and more technicians. The present technician is developed from youngsters who have varying high school backgrounds. This program will offer a well-rounded education to high school students interested in the technical field. It will give students the opportunity to explore college prep subjects from the practical application view rather than from the abstract. With this grasp of fundamentals, students will be able to go on to technical institutes, colleges or vocational schools with backgrounds that should insure success.

**HOW ARE HIGH SCHOOLS MEETING THIS NEED?**

Currently, the only preparation is in the traditional college prep track, which has emphasis on the abstract. There is little or no opportunity for the exploration of drafting and shop experiences, two necessary fundamentals for technician training. Further, the sciences are not related to the practical shop experiences that would make them real.

**IS THIS A "WATERED DOWN" COLLEGE PREP TRACK?**

This is a specialized track, featuring practical learnings, to develop technical-minded high school students who can move into technical institutes with a solid background. The high school student, with technical leanings, can be given a practical college prep education which will serve him well in these institutes. The engineering technician is a member of the largest single group of specialized graduates from schools of higher learning. This fact cannot be ignored.

We believe that with enthusiastic teachers and a properly motivated group, evaluation will show that these students will compare most favorably with their counterparts in the traditional college prep track.

Should a student find the Program not meeting his needs, he may be moved into another track.

WHY IS THIS PROGRAM "SPECIAL"?

This is the first Program to consider the average student in relation to higher education. This is the one who is often neglected while the gifted and retarded are provided for in special programs.

Ultimately there will be three paths in the Program: one for the engineering technician, the vocational technician, and the craftsman.

The Program is geared to wide area needs of technicians in industry.

We must accept the fact that our economy requires a continual flow of technicians. The high schools are failing when they refuse to recognize this precept.

WHAT ARE SUCCESS POSSIBILITIES OF THE PROGRAM?

In our district we normally average about 33% of our high school students in the college prep track. We have data to indicate 5 - 10% of all high school students graduate from college, which at best would mean 1/3 of those who were high school college prep. What happened to those who failed? How are they prepared to earn a livihood?

With proper instruction and counseling, at the appropriate grade level, we could - and should - find that the majority of those who are not succeeding could find a useful and interesting place in industry.

HOW WERE THESE CONCLUSIONS DERIVED?

At a Summer Workshop, 1961, 11 educators worked on the Program. Prior to developing concepts, beliefs and curricular offerings, they were involved in discussions with representatives from technical institutes, persons in industry, and research and technical institute graduates. They found out that industry has need for the technical institute graduate as he is now trained; that this training is modified to the needs of industry. The technical institutes said, "Give us students with this high school background and we can do a better job of training, and place them in industry or research."

With this background and these understandings, we propose this Program.

## FOREWORD

Culminating a pre-engineering technician Program workshop, during the summer of 1961, the following materials and recommendations were developed. Workshop participants included personnel from De Anza and Ells high schools in Richmond, and staff members of Cogswell Technical Institute of San Francisco. The general plan during 1961-62 is to identify the student, counsel with him and with his parents, and program him to his 11th grade course of study. In addition, selected, interested teachers will be offered the opportunity to develop subject matter, determine texts, select teaching materials and aids and attend in-service training programs sponsored by agencies without the school district.

Currently industry has a tremendous need for trained technicians. Sources of supply are graduates of technical institutes, college engineering students and high school apprentices.

The best source of technicians is from the technical institute. However, these institutes derive their trainees from high school students who are either traditional college prep or those with no inclination to attend college. This results in the institutes offering a make-up program that could be eliminated if students had a proper high school background.

A pre-engineering technician track in the high school would afford a rich curriculum to students who could go on to technical institutes and within two years receive the training necessary to prepare them for industry.

Currently technical institutes place all their qualified graduates and could fill many more positions, if they had the student personnel. This situation is becoming even more acute.

It is imperative high schools recognize this fact and take the initiative in preparing capable students for this advanced training and eventual employment.

## PURPOSES OF THE PROGRAM

The prime purpose is to give a pre-technical training to high school students, not to graduate "technicians". The aim is to motivate the potential achiever through application of practical teaching in all Program oriented subjects so that concrete goals are recognized by the student. Learnings are to be constantly emphasized as necessary tools for the application of theories to working situations. The step-by-step learning program will ultimately lead to his successfully completing technical institute training and eventual employment.

Through team teaching, correlating academic subjects to the technological laboratory and through constant theory/application techniques, the student can empirically develop an appreciation of subject matter that will aid him in establishing realistic goals.

Finally, the Program is offered as a potential aid to the mental or psychological high school drop-out -- that student who finds himself unable or unwilling to compete with fast learners in the college prep program and drifts through his high school years barely passing. He has no goals and no motivation.

## COUNSELING AND ADMINISTERING THE PROGRAM

To understand the Program there is a need to understand definitions, purposes and the role of personnel involved.

## DEFINITIONS

Technician: The post-high school, formally trained member of an engineering team who correlates the theoretical sciences to the practical arts in the design and development of the ultimate product.

The engineering team is made up of the engineering scientist, engineering technician and the craftsman.

Technical Institute: An institute of higher learning beyond high school, usually found as a division of a public or private junior college, whose purpose is to offer a formal training in the field of engineering technology.

Pre-Technician Program Student: The capable, average college prep student who exhibits, through desire, teacher observation and standardized tests, the potential to succeed in an engineering technician program. Also included in this Program would be the capable student from any track who could meet the described criteria.

Pre-Technician Program Teacher: The teacher who has full knowledge of the theory of his subject and the ability to apply this theory to practical situations in the technological laboratory. In-service training will supplement his educational background.

Counseling: The student to be counseled into this program will be selected by evaluating:

1. teacher observations
2. student interest and motivation
3. accumulative test data
4. academic records
5. parental interst

Teachers within the Program will offer guidance and assist as group counselors.

Continual accumulation of data will be an integral phase of the Program.

The counselor will accumulate all data, arrange for individual and group counseling conferences and be ready to make recommendations on all phases of the Program.

The Teacher: Is responsible for developing and implementing an inter-departmental curricular pattern that will meet the objectives of the Program. Individual recommendations will be reviewed by the Program teachers.

Administration: The district Program will be under the direction of the Director of Instruction. The Administration of the local school Program will be under the supervision of the principal, or his delegated authority.

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## COGSWELL POLYTECHNICAL COLLEGE: (San Francisco)

In 1962 the officials of Cogswell Polytechnical College (a two-year technical institute) devised an experimental plan for training technically-oriented pupils in the last two years of high school. Under a grant from the Rosenberg Foundation, the project was launched in two Richmond, California comprehensive high schools.

The Richmond Plan is designed to offer high school students basic technical training leading to employment, as well as stimulating them to continue their education in a junior college, technical institute technology program, or at a four-year college. Such continuing students will eventually qualify for careers as high-quality engineering technicians or even as engineers.

The program is designed to appeal to boys with a broad range of intelligence and abilities, who have mechanical aptitudes and talents, and who have been under-achievers in the ninth and tenth grades. The group includes students who have not been motivated by the academic and industrial arts courses, as well as potential dropouts, and some who have been constantly referred to counselors as problem cases. Students who meet these criteria and who also display interest in some form of mechanics are identified. A record of earlier failure in academic courses in no way disqualifies students.

The program consists of a two-year sequence of four major courses starting in the eleventh grade. The major courses are English, physics, and chemistry (1-1/2 years of physics and 1/2 year of chemistry), mathematics through trigonometry, and technical laboratory (an integrated shop course including drafting). Students take these subjects as a group, but mix with the rest of the pupils for the other courses normally given in the eleventh and twelfth grades (history, social studies, physical education).

The natural relationship of each subject to the others is drawn out and used for constant reinforcement. For example, the study of heat taught in the physics class (through the first law of thermodynamics) is related in mathematics to first degree equations (necessary for linear expansion), supported by the construction of apparatus in the shop to conduct experiments, and is followed in English class by oral and written reports on this subject. No attempt is made to create an artificial content, though. The inter-relationships between the subjects are taught as an addition to the objectives of the courses themselves.

Team teaching is an integral feature of the program. Teachers, especially trained in summer workshops to work with these students, function as a team to plan and evaluate the program and its results. They hold several conferences a week to review progress and to coordinate the next week's

lessons. Programmed instruction is utilized in teaching mathematics and English.

The technical laboratory is an integrated shop program that is not intended to train craftsmen. Manipulative skills and familiarity with tools and materials gained here enable students to apply the theoretical knowledge covered in other courses. This helps them see the relationship between theory and practice. As a byproduct, they learn to handle the basic tools and equipment they will use when employed.

The program uses the vocational interest of the student as a motivating force behind a sound educational program. But the vocational interest does not lead to an educational dead end. One of the purposes of the program is to stimulate and assist students to develop their talents to the highest possible degree. Although the largest number of students will probably aim at the two-year post high school technological program, other choices are open to them. Those who decide not to continue beyond high school will have received a sound secondary education, will be better placed to get jobs in industry because of their skills and knowledge of tools and materials, and will be better prepared to enter an apprenticeship training program. Those who continue in the specially designed junior college technology program will be better prepared than they would otherwise have been, and thus should be able

to get more out of their junior college education. If they elect to go into industry on completing their junior college program, they will have a solid basis of industrial, engineering, and technological knowledge and skill useful in a broad variety of jobs. Students who elect to continue their education beyond junior college can transfer to a four-year engineering college or to other four-year college programs. If they elect the latter, they may need six additional units of a foreign language and evidence of English proficiency. But these additional requirements are not necessary for admission to some four-year college programs.

The project is admittedly an experiment and still in its early stages. But in a relatively short period, teachers report that the students have been transformed from non-achievers to hard-working students who are proud of their work and interested in their studies. They desire to continue in school and appreciate the importance of subjects in which they had previously done poorly. Prior to their enrollment in this sequence, most of the students had received barely passing or failing grades in English and history; at the end of the first semester only nine received grades of less than average in these subjects. The entire program is being evaluated over the next three years by Dr. Ralph Tyler of the Center for Advanced Studies in the Behavioral Sciences, Stanford.

The Foundation grant of $185,000 over three years is enabling Cogswell to complete development of this experimental curriculum and to extend it to ten other Bay Area high schools and two public junior colleges (which will revise their programs to meet the needs of graduates from the high schools). If successful, this program should generate some new ideas useful to educators elsewhere who want to improve vocational education in various subjects and at various grade levels, particularly in regard to curriculum, teaching methods, guidance, and articulation between secondary schools and junior colleges and technical institutes.

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# TEACHING METHODS

FOR

# "THE RICHMOND PLAN"

Cogswell Polytechnical College
3000 Folsom Street
San Francisco, California

date ?

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COGSWELL POLYTECHNICAL COLLEGE

## PREPARING INSTRUCTIONAL PROGRAMS FOR THE "AVERAGE LEARNER".

**Foreward:**

We are at a stage in the RICHMOND PLAN where we feel it is now necessary to ask for "in-service training" for the teachers involved in the program. The results of the program thus far are most gratifying. The students have been identified; the curriculum established; and the cooperation of the District assured. The problem is now to develop teaching methods which will materially strengthen the Program.

There are striking differences between the teaching methods in engineering technology and other programs. What we generally say in Technical Institute Education, is that we are teaching "applied subject matter" rather than "theory." This statement immediately arouses responses from people concerned with education. "Applied subject matter" means to some:

1. "Watered down."
2. "Cook book."
3. "Over-simplified."

For others it means that the teacher must at least be an engineer to understand where the subject matter is being used. There is still another group who consider applied subject matter to mean "busy-work project building"--- whether the projects have any relation to the program or not.

There are seven areas in program development where the teachers in the RICHMOND PLAN do need guidance and the opportunity to prepare curriculum materials from a different point of view than they have experienced in the past.

INTRODUCTION

In preparing the Course Outlines for the RICHMOND PLAN, it is necessary to make two assumptions about the instructors concerned:

1. We assume that it is important to the instructor preparing the program that every qualified member of his target population will achieve specific objectives.

2. We assume it is important to the instructor that he will be able to demonstrate that his educational objectives have been achieved.

With these two assumptions in mind, it is now possible to prepare instructural materials that are very much different from the traditional methods used in the secondary schools.

STEP 1 - Definition of the Student.

One result of the preliminary work-shop held last summer at Cogswell was the ability of the teachers to write a brief description of the students for whom the program is to be prepared. A description of the target population orients the teachers thinking with respect to the vocabulary and explanations that he can use and the background assumptions he can make. This step is fairly simple and each of our teachers is highly qualified to do this.

STEP 2 - Specify the instructional objectives.

It is primarily in this area that our instructors need guidance and time. This step is the most important part of the entire program. To build a curriculum that works it is necessary to spell in behavioral terms just what the learner will be doing when he is demonstrating that he has achieved the specified objectives. Similiarly, before a program can be evaluated, the objective must

be spelled out in measureable terms. It is absolutely necessary to specify objectives clearly in order to "teach a course."

(To explain how the instructional objectives for the third track are not the same as those traditionally offered in the high schools, we have included with this paper, in the Appendix, an example of a Course Outline in one unit of approximately two weeks.)

The importance of preparing a statement of objectives for each educational intent cannot be over-emphasized, and the benefits of doing so are many. With objectives (stated in behavioral and measureable terms) it is possible to evaluate the effectiveness of an instructural program. With objectives, there is a sound basis for selecting and sequencing learning experiences. With objectives, it is less likely that the teacher will fall into the trap of equating the difficulty of content with its importance. With objectives, the student is provided a tool which allows him to organize his activities effectively and prevents him from having to develop a bag full of tricks designed to rub the teacher the right way. The teacher will operate in a fog of his own making until he knows just what he wants his students to be able to do as a result of his instruction. Every student in the third track deserves to know exactly what he is required to learn, and why he is learning that particular subject, in terms of what he is going to do in the near future. The student should never have to second guess the instructor, his text book, or the program. He should be told not only what he will be able to do, but what he will NOT be able to do,

A statement of objectives will answer the following three questions:

1. What will the learner be DOING when he is demonstrating that he has achieved his objectives (since we cannot look into the minds of others we can only infer the state of their intellect by looking at something they have done or are doing)?

2. What important or special conditions will be imposed on the learner when he is demonstrating his achievement of an objective?

3. What will be considered satisfactory performance - - in other words - - how will we know that the learner has actually succeeded in achieving the objectives. What will be accepted as evidence of satisfactory performance quality?

We could never, as it is commonly done in education today, possibly list a vague and generalized objective for the students in the third track, such as, - the learner will develop a certain amount of "confidence" in his handling of some subject matter or he will develop "critical attitudes." It is necessary to decide for our students, just what we will accept as <u>evidence</u> of "confidence" or "critical attitudes," and describe these behaviors in separate objectives.

For example, a common objective of a course in music is to "appreciate classical music." The problem for students in the third track, if they were to take a course in music appreciation, would be "how do we measure at the end of the course, that the student appreciates classical music?" If this course were to be part of our program, we would have to list the objective in behavioral terms. For example, we might say, the objective of this course is to be able to recognize after 14 measures certain pieces of work written by Bach, Beethoven or Brahms. An objective of a course in 11th grade Civics could not be a vague statement such as "to appreciate democracy" or "to understand the world

we live in." What the teachers must do is re-write these objectives in terms of behavior. It is the desired outcome, therefore, that we consider to be "applied learning."

STEP 3 - Preparation of the criterion examination.

We are interested in demonstrating that the students in the third track have achieved the objectives specified in the previous step. To prevent the teachers from falling into the trap of writing a test which measures whatever it is they have happened to include in the way of content, rather than one which measures how well they have achieved the specified educational objectives, we must teach these instructors to prepare the criterion test BEFORE they prepare the curriculum. For only when the members of our student population perform satisfactorily on the criterion examination, have we completed the teaching task. This means that our instructors must decide before hand what they consider "passing." The teachers must re-orient their thinking so that they are not interested in evaluating the student on the basis of how well, or how poorly, his peers happen to perform. (We are not interested in grading on a curve, but in evaluating each individual student on the basis of how well he has reached the specified objectives.)

STEP 4 - Preparing a list of pre-requisites.

The instructors must know exactly what they are going to assume in respect to the prior knowledge and experience of their target population. They need this list so that they cannot blame previous schooling for the failure of their students to have obtained particular objectives. Every time they assume that the learner understands the meaning of a particular term, or that he will be

able to handle some particular concept, they must add this to their list of pre-requisites. Without this list, they would have no idea as to why certain students might not have met the objectives of a particular course, and it would then become necessary for the teacher to teach those pre-requisites.

STEP 5 - Preparing the content outline.

Since most of our instructors are expert in the subjects they are teaching, it is usually relatively simple for them to prepare a content outline. However, it is because they are experts in the subject matter that they are likely to leave out some of the important steps necessary to learning the subject matter. Such statements as, "It obviously follows that..." or "the proof of this is left to the diligent student" is of little help in the third track.

STEP 6 - Preparing an initial course sequence.

On the assumption that what is meaningful to the instructor, is not always meaningful to the student, it is necessary in programming the RICHMOND PLAN that the material be sequenced as if the learner had some say on the matter. If traditionally in a course in physics, mechanics is taught first, and if in this program, utilizing the team-teaching approach, trigonometry might not be offered until later in the semester - it might be necessary to change the course sequence to meet the students needs.

STEP 7 - The selection of the major teaching strategy.

The primary goals of any program involving "average learners" are:

1. To provide information to the student in small increments.
2. To cause the average learner to make responses conducive to

his developing the desired proficiencies.

3. To let him know how well he is doing at every step of the way.

4. To have the student demonstrate that he has reached the desired objective with some change in his behavior.

For many teachers, working with the "AVERAGE LEARNER" necessitates a rather serious change in attitude, for in this program the teacher must accept the blame if the student does not understand (for whatever reasons). When a colleague points out an information gap, the teacher cannot say, "Well, we've got to assume they know something." When a student who meets the prerequisites, does poorly on a criterion examination, the teacher must say, "I guess I didn't get the point across", rather an "If the student had paid attention he would have understood it." The teacher must avoid becoming defensive. Every time a student fails, the teacher must say, "Obviously, I didn't make my self clear, let me try again."

## CONCLUSION

Industrial training programs, commonly utilized in most of the manufacturing industries, have a zero to 2% failure rate. While it is true that the students selected for industrial training are not randomly chosen, many of the techniques used in industry could be utilized in the RICHMOND PLAN. We strongly feel that in addition to the Saturday meetings if all the teachers in the RICHMOND PLAN were given an opportunity this summer to develop their curriculum materials along the lines described above, the program in the school would be greatly strengthened. What we plan to do is use many of the industrial training techniques of industry in developing these materials. If, during a six week period, the teachers could develop their materials under the guidance of our own staff as well as members of the Penninsula Industries, they would be given one final opportunity to alter their thinking from the traditional point of view.

* * * * *